II. Historical perspective: *Regional issues and evidence for regional scale transport*

The global dissemination of anthropogenic pollution has been a focus of environmental concern for over two generations. Over the past decade, this concern has centered on the emission of long-lived, radiatively important trace species and the influence that their increased concentrations may have on global and regional climate. However, the chemical properties of anthropogenic pollution are also recognized as a global environment problem.

Over two generations ago, the long-range transport of chemical pollution became a concern with the recognition that lead, principally associated with the use of tetraethyl lead as a motor fuel additive, was being distributed globally. This finding coupled with the known toxic properties of lead caused its removal from fuels as well as cessation of other applications. Likewise, the observation of the long-range transport of chemical pesticides, such as DDT (dichloro-diphenyl-trichloroethane) and other organochlorine compounds, and their ecological damage, has been a subject of study for many decades and continues to the present.

The present interest focuses on species that have an atmospheric lifetime of days to months. Substances with the longer lifetimes are reasonably uniformly distributed on a hemisphere-wide basis. Those with the shorter lifetimes can be significantly redistributed from their sources across national boundaries and into marine regions that border the continents or under favorable conditions over even longer distances. There is evidence that such transport is involved in acid rain and in the anthropogenically perturbed levels of ozone, aerosols, and certain long-lived volatile organic compounds (VOCs).

Potential adverse effects associated with acidic deposition became a concern in the 1970s in North America and Europe. This deposition was causing acidification of lakes and there was concern that there was also potential for damage to forests. The increase in acid deposition was linked to emissions from industry, electric power plants and automobiles. The oxides of sulfur (SO_x) and oxides of nitrogen (NO_x) that were emitted from the sources were further oxidized in the atmosphere to sulfuric and nitric acid and subsequently incorporated into aerosols and clouds. These acids and their precursors could be transported hundreds or, perhaps, thousands of kilometers from their sources, crossing national boundaries. This was recognized as an international problem in North America and Europe.

Ozone, which is formed by photochemical reactions involving NO_x and volatile organic compounds (VOCs), was long recognized as one of the principal constituents of urban

photochemical smog. However, in the 1980s, ozone pollution was identified as a regional problem and the transport of ozone across national boundaries was viewed as an international issue in North America, Europe and, most recently, in Asia.

Like ozone, atmospheric aerosols are generated by chemical processes in the atmosphere involving gas-phase precursors from anthropogenic and natural sources. They may also be generated mechanically (wind, cultivation, etc.) and chemically (industrial combustion, biomass burning, etc.). The intercontinental transport of wind-borne dust has been observed for many years. Satellites have followed the plumes of smoke from forest fires over thousands of kilometers. The radiative properties of aerosols have become the focus of the atmospheric science community associated with the effect that these particles can have on the global climate. Interest in the optical properties of aerosols also is related to the influence these particles have on visibility. Visibility affects air transportation and detracts from the esthetics of scenic features. Most recently, findings have related fine particle concentrations to health effects. This has stimulated considerable new interest in the sources and processes that control the atmospheric aerosol distribution.

The broad range of effects associated with the chemical properties of the atmosphere has generated a major international program aimed at studying and understanding the processes that control those properties.